# N.A.C.A. BULLETIN

In Two Sections

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## EDITORIAL DEPARTMENT NOTE

It is probably true that the great accumulation of inventories by manufacturing companies which have been reported recently is due to a number of factors. Probably one of the most important of these is lack of good production control which has made unnecessarily long the spread of time between the receipt of material and its sale as a part of the finished products. The production control methods of many will be up for review and overhauling in the months immediately ahead and the accountant will have a part to play in improving the control system. The case study of the production control methods of the International Harvester Co. in this issue will help to clarify his thinking and his understanding of objectives in this area.

L. W. PERKINS, the author of this article, is General Production Manager of the International Harvester Co. During his twenty years with his company he has been responsible for the installation of modern methods of production and material control in their many plants.

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If the accountant is to take to heart the admonition in the last issue of the *Bulletin* regarding salesmanship, one of his first steps should be to consider the needs of his customers—the user of his product. What does management need and want from the accountant, in what form, in what detail, and for what purpose? Knowing the answer to these questions the accountant is in a position to design his products for ready sale. The second article in this issue of the *Bulletin* provides an outline of management needs from the viewpoint of the operating executive.

THOMAS M. CHALMERS, the author of this article, speaks from experience as Vice President of the Tennessee Coal, Iron & Railroad Co., responsible for the operation of the integrated facilities of this company engaged in the manufacture of iron and steel products. Mr. Chalmers is a strong exponent of the development of improved control accounting and sponsored his company's industrial engineering program which was started in 1936.

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Articles published in the *Bulletin* present many different viewpoints. In publishing them the Association is not sponsoring the views expressed, but is endeavoring to provide for its members material which will be helpful and stimulating. Constructive comments are welcomed and will be published in the Forum Section of the *Bulletin*.

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DECEMBER 15, 1946

# A CASE STUDY IN PRODUCTION CONTROL

by L. W. PERKINS, General Production Manager,
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PRODUCTION control means literally the planning, scheduling, dispatching, and expediting of machines, material, and men within a plant. Because the term has acquired a semitechnical meaning many industrialists regard production control as something highly complicated and mysterious. This is not the case. Production control is simply the application of common sense to the problem of planning, executing, and accounting for a program of material conversion. The objective of production control is to obtain the highest efficiency in the utilization of invested capital by producing the required quantity of product, of the required quality, at the required time, by the best and most economical method.

The International Harvester Company, with general offices in Chicago, produces its products for domestic sale in nineteen plants widely distributed over the United States. We of Harvester are in a widely diversified business. We have plants that produce farm tools that require very simple operations, hence our production equipment is very flexible and programs can be changed from one model to another without unduly upsetting the over-all capacity of the works. As an opposite extreme we manufacture heavy-duty motor trucks that require precision equipment for specific models and designs where a change in model production can disrupt all the planning that has gone before. Between these extremes we have a wide variety of manufacture, including heavy crawler-type tractors, Harvester threshers and corn pickers, small, medium, and large wheel tractors, diesel engines, cream separators, and many other products. We do not attempt to adopt the same degree of production control in all of these plants. In principle we maintain the same basic records and controls, but the extent of their application is dependent upon the type of product and methods of manufacture of each respective plant.

### *Plant Utilization and Production Control*

Some years ago our company recognized the necessity for better use of assets. The largest single investment in our balance sheet was that of inventory; more than our total investment in buildings,

machinery, land, and equipment. A substantial reduction in this asset was a definite necessity. We realized that to accomplish a reduction in this investment and at the same time entertain the same or larger volume of sales, it would be necessary to improve our control of the flow of material into our manufacturing plants, through the various operations of production, and into the hands of our customers. To accomplish this objective we had to improve our sales forecast, our method of developing schedules on plants including the calculations of plant capacities, the scheduling of material closer to usage date, and the control of material or parts through processes of fabrication and assembly in accordance with a distribution pattern. This to us represents production control in its fullness, for we believe that our inventory turnover in producing any given program is as important as the completion of the program within the scheduled date or period.

To accomplish the objective a new division was organized in our general office, headed by a vice president and known as Supply and Inventory. In this division there are three departments: estimating, materials control, and order and distribution. It is the responsibility of the estimating department to determine sales estimates for the company. The materials control department has the responsibility of converting this sales estimate into production programs and executing this program by coordinating and controlling the flow of materials to all of the plants' facilities. The order and distribution department is responsible for the distribution of all finished goods as well as the inventory of finished goods.

***Sales Estimates***

Before the establishment of an estimating department, our sales department made its sales estimates based on data supplied by our branch managers. A branch manager would not be a salesman unless he was optimistic regarding the amount of business it was possible to do in his territory. We were dependent upon one hundred of these optimists to give us a requirement to manufacture. Our history of these sales estimates is that in a good year we always predicted that the following year would be a better one and during a declining demand our estimates always indicated the opposite trend. Consequently in our manufacturing plants we were continually changing our plans, buying new equipment, and investing in materials to produce greater quantities of product than could

be sold. Or else we did the reverse by curtailing employment to get production down to the declining requirements of the sales force.

Since the organization of the estimating department we are getting more realistic estimates than were possible under the old organization. Full consideration is given to sales history, dealer and branch house inventories, changed usage of product, weather outlook, market possibilities, and economic factors. I maintain that it is impossible to exercise production control successfully without accurate estimates of requirements. Controls at the plant level serve no purpose if programs are constantly being changed.

***Production Program***

After the sales estimates have been determined, all managerial activity of developing a production program and executing this program by coordinating and controlling the flow of materials to all of the plants' facilities is performed by the works materials control department. This department was organized to coordinate the plant material and production control functions with over-all company supply and inventory policies. As previously stated, the degree of production control we have at any one of our plants is dependent upon the type of product produced. The discussion which follows is concerned with one of our mechanized works making our Harvester threshers and corn pickers. This plant produces seven different models of Harvester threshers with a total of 29 line machines. These machines can be shipped in 256 variations or combinations of shipping packages. It also produces four models of corn pickers with a total of 17 line machines and these machines can be shipped in 44 different variations. Their Harvester thresher attachments consist of approximately 72 general groups with an average of six variations each. Corn picker attachments have 17 general groups with an average of five variations each. In addition to this they service 26,000 items through their service parts department for both their current and obsolete lines.

The works production control department is called materials control department as is the case in all our plants. The individual in charge of this department is known as the materials controller and has under his leadership four departments—production forecasting, materials scheduling, production scheduling, and storekeeping. Each one of these departments has a department head and all function with three objectives in mind:

1. The maximum utilization of the plant's facilities to manufacture within the framework of their manufacturing authority.
2. The fulfillment of production schedules so that machine, attachments, and service parts will be available as required by our customers.
3. The maximum utilization of inventory so that all inventory is turned over as frequently as sound policies permit.

***Production Forecasting***

Sales estimates and manufacturing authority for machines are received at the works quarterly. Each of these programs covers a twelve-month period—a review of the nine months previously covered plus a new requirement for the following three months. In this way we always have a program or estimate of work for a minimum of nine and a maximum of twelve months in advance of the current month. This gives an opportunity to cycle our production properly, regulate our employment, and plan for the maximum use of our facilities. Based on historical records, the production forecasting department forecasts miscellaneous attachment and service parts requirements for periods covered by the manufacturing authority for machines. From this the forecasting department is in a position to develop a master schedule of production covering the plant's full requirements. This entire program is scheduled on the basis of end products according to the season's requirements, and is then broken down into assemblies, subassemblies, and individual piece part requirements. This is done through the explosion method. From this a machine load is determined. Plant management goes over this program very carefully to see where bottlenecks have arisen and to determine the policy of employment, farming out work, and over-all plant management for the ensuing twelve-month period. After the program has been approved, it is returned to our supply and inventory division where it is combined with other programs from all our various operations and used for the fiscal planning for the entire company. This schedule when finally determined becomes perhaps the most important single document in our business. From it, our treasury department plans its financial policies, our order and distribution department its pattern of distribution of these goods, and our sales department its sales promotion program. At the works level, this schedule is of equal importance, for it is the source document for all materials control

activity. After final approval, the production schedule is turned over to the materials scheduling department.

***Material Scheduling***

This department breaks down the schedule in terms of prefabricated and raw materials and spreads the results on its records. It then places requisitions with our purchasing department for delivery of these components at the proper time to fit into the program. In placing requisitions for materials we take into consideration application of inventory, proper lead time, minimum shop runs, and minimum procurable quantities.

Incidentally, we have recently entered upon a program of obligating ourselves to suppliers for only a minimum length of time ahead of actual requirements. With the advent of World War II and the Controlled Material Plan, the importance of monthly scheduling became paramount and in order to obtain delivery of items and materials it was necessary to place these monthly schedules with our vendors in the form of a bona fide purchase order to the full extent of a contract, allotment, quota, etc. This meant that in most instances we were required to place firm orders with vendors for a period of twelve or more months and to indicate a monthly delivery schedule covering this period. This, however, has changed. We realize the importance of telling our suppliers nine to twelve months in advance what our requirements will be in as much detail as possible, so that they may provide proper facilities and manpower to meet this over-all requirement. We are giving this to them in the form of an estimate. In many instances this estimate covers only total requirement of product such as the quantity of fractional horsepower motors, so many million friction or antifriction bearings, tons of steel, etc. With some suppliers it is necessary to go into more detail. Against these estimates, we give the supplier a firm schedule or release for shipment six weeks in advance of the current month and in addition we give him a two months' tentative schedule. We find more flexibility in this program and considerably less paper work. The plan has worked out very satisfactorily from the standpoint of both the suppliers and ourselves.

In the same record in which the materials scheduling department posted its material requirements by months, the material schedulers post their requisitions placed and the delivery schedule requested. This record also provides receipts, reservations, and disbursements. Thus in one record the works has the complete picture of its ma-

terial status on any given item. It is the duty of the materials scheduling department to approve all material releases for production as well as provide shortage lists for any program or parts thereof.

After the master schedule is established and the materials scheduling work completed it is the duty of the production forecaster to check this program constantly against his future demand so that we are assured that forecasted programs will meet our shipping requirements. This checking is accomplished by posting orders for both machines and service parts for future shipment and demand to the records. This record also shows our contemplated scheduling, so by comparison we can adjust our program or adjust shipping requirements. We endeavor to provide our works with from four to six months' future shipping orders.

***Central Receiving and Inspection***

The function of controlling materials and parts from the point of receipt to the delivery to producing departments through properly authorized releases or requisitions is under the supervision of the storekeeper and is divided into three distinct functions; namely, receiving, storing and protecting, and disbursing. These three functions are a definite part in the materials control program and must be governed by the requirements of a predetermined production program in accordance with sound procedures.

The first step in the development of good receiving procedures is the establishment of a centralized location for the checking, inspection, and dispatching of all incoming material into a plant. Central receiving is essential for many reasons:

1. It provides a central point from which all incoming carriers may be routed, thus preventing unloading at a wrong delivery point. From central receiving, full truck loads of material for one department can be routed to other unloading docks and carloads can be spotted.
2. It provides the facilities for inspection of all incoming stock at place of receipt, thus assuring correctness as to quality and condition before dispatching to various departments.
3. It supplies a central control for the intraplant dispatching of all incoming material. This should be especially advantageous where stock is nearly depleted, inasmuch as stock

can be dispatched based on the minimum requirements of each department, thereby eliminating the necessity of one department borrowing from another.

4. It provides for the centralization of records which will make it possible to obtain information from materials stores with speed and accuracy.
5. It assures a check on all incoming receipts inasmuch as all outside and interworks purchases must clear through this control location. This is essential for adequate materials control and accounting procedures.

After receipt and check against freight bills, materials and parts must be adequately checked for quantity in accordance with our accounting department's prescribed procedures. Unless receipts of material are accurately reported as to quantity, accurate payment of invoices cannot be made, nor accurate statements of availability of material be secured.

***Routing Incoming Material***

A materials delivery order is attached to the material by the receiving checker before it is moved from the receiving and inspection departments. This delivery order is originated by dispatching clerks in the central receiving office from information derived from the vendor's packing slip and is augmented by whatever other notations are found necessary by the receiving checker. Such additional information covers a division of the shipment into two or three lots, each of which will be dispatched to different locations, such as using department, service parts bins, and temporary storage area.

Whether parts or material are to be delivered directly to using department or temporarily stored, consideration is given to the benefits derived by individual palletization of the item to eliminate excessive handling and abuse of material or parts. All recommendations for individual palletizations must be cleared through and approved by the storekeeper before pallets are designed.*

Through proper functioning of the material stores department in accordance with the above procedures we are assured of the following controls which are a "must" program:

1. Control of receipts in accordance with schedules furnished to vendors.

*A pallet is usually a two-faced skid consisting of two flat surfaces held a few inches apart by cross pieces, the space between being for the insertion of the fork of a truck.—Production Handbook, Alford & Banga.

2. Assurance of accuracy in counts.
3. Controlled dispatching from receiving and storage in accordance with requirements.
4. Protection of material and parts in handling through palletization.
5. Protection of material and parts in storage against spoilage and deterioration.
6. Accurate records on receipts and disbursements of material and parts received and stored, providing a dependable stock status report.
7. Minimum amount of storage space.
8. Savings in handling and storing.

We have covered the works' methods and controls up to the point of actual production by:

1. Long range forecasting constantly being modified to future demand and change in trend.
2. Materials ordered with necessary lead times to meet this program and modifications.
3. Material and parts accurately received, dispatched, or stored subject to withdrawal in accordance with requirements.

***Production Scheduling***

The remaining function of scheduling production requirements for the manufacuring and assembly departments to meet an end product schedule under our material control plan is the responsibility of the production scheduler and his staff. Production scheduling, as used in connection with materials control, is the equivalent to production control and means literally the planning, scheduling, dispatching, and expediting of materials and parts through the process of fabrication, subassembly, and final assembly within the plant to meet a given end product requirement.

The method used in forecasting the plant's end product requirements for a period of not less than twelve months was explained earlier in this paper. The production scheduler through the use of machine loads and assembly capacities accepts or modifies the program within the plant's ability to produce. Manpower requirements and shifts of work have also been analyzed. By this forecast and accepted schedule of production of end products, we have the basic information necessary to determine parts and assemblies necessary

to produce in each month, period, or day so that requirements are available to assemble end product schedules. Specifications are available on the same basis as end products are manufactured in the plant (manufacturing specifications). This type of specification will provide bills of materials for shop assemblies and also part numbers for these assemblies. This information is essential in scheduling and controlling work in process inventories. It is only by means of manufacturing specifications that accurate requirements for scheduling purposes can be obtained.

After arriving at total requirements of parts and assemblies necessary to have available to meet a month's requirements of end products, the lead time necessary to fabricate and subassemble each part and assembly is applied so that the production scheduler can determine the bank or stock floats of parts or assemblies necessary to produce in order to insure continuous operations.

***Departmental Production Releases***

With the analysis of end production requirements that are within the capacity of the plant to produce during their required schedule period and lead times established for each part or assembly or established production stock bank, the production scheduler is in a position to prepare releases for the fabrication and assembly to the respective departments to meet a given month's production. In plants capable of operating on a minimum bank of parts or assemblies ahead of the assembly of end product, releases for a given month cover the end product requirement for that month, whereas in plants operating on stock banks equivalent to 30 days or a large part of a month, releases for a given month cover the end product requirement of the following month. Exceptions to this occur where it is advantageous and within the existing capacities to release minimum shop runs that are in excess of a month's requirements.

The production scheduler now has the individual requirements of four schedules, namely machines, attachments, service parts, and collateral. These four requirements must be combined in order to release manufacturing of any given catalogue number for the total requirement of that period or month. Forms known as "production cards are available for this purpose. With production cards completely posted, the production scheduler has a complete record including banks or lead times on each catalogue number of the season's requirements exhibited on a monthly basis. Production

cards also show the analysis of each month's requirements between machines, attachments, service parts, and collateral for the purpose of routing and dispatching after final operation.

Having developed from the original or modified master schedule the monthly requirements of all parts and assemblies, the production scheduler then has the responsibility of releasing each month's requirement to each production department. Releasing of production for fabrication, subassembly, or line assembly is done on a monthly basis and is in the hands of the operating departments at least ten days prior to the schedule month, for the purpose of planning. We use a single item release for use in all scheduling. You will find many types of schedules and releases in use by industry, such as master schedules from which departmental part requirements are drawn by each department from records within the department, multiple type releases upon which a group of catalogue numbers are scheduled, and individual releases of various types.

***Individual Production Releases***

Individual releases enable the works to gain the following advantages that cannot be attained by other methods:

1. Individual releases allow the production scheduler to check each release for availability of material either through stock status reports or manually by the material scheduler's records. Any catalogue number for which material is not available can be held for availability and balance of items released.
2. By the use of individual releases production clerks and foremen can sort or arrange their month's production requirements to meet the scheduling requirements of their individual department from which can be drawn schedules by machine tools or the cycling requirements of each machine tool.

Individual releases show catalogue number, month, part name, blueprint change, total required showing split between machines, attachments, service parts, and collateral; also routing, completion date, material requirements, and space for inserting operations for the benefit of the production clerk and foremen in planning. Releases are typed and then quantities to be scheduled are developed and inserted by production schedule clerks. Sufficient copies of the release are provided so that the originating department will have

two copies and one copy for each department involved in the routing of the part. The second copy provided the originating department is used as a material requisition and disbursement. No material or prefabricated part can be delivered without a material release to cover the disbursement.

After releases are typed, scheduled, and posted to production cards, they are checked against the stock status report or the material scheduler's records and approved for availability of material as previously explained. Any catalogue numbers for which material is not available are held up pending receipt of material. Releases held up furnish the basis for a material shortage report for that period.

By the procedure described up to this point, we have assured the supervision of our production departments of the following controls before releasing their given month's production program:

1. Accurate requirements in accordance with end product requirements.
2. Through the use of machine loads and other related data that a given month's production is within the capacities of the respective departments.
3. That material is available on all releases before releasing to the shop.

***Production Control at Departmental Level***

Each productive department has the services of a production control clerk whose duties are as follows:

1. Receive production releases each month.
2. By consulting with foremen and use of machine load data, plan and lay out operations for starting and completion dates within the schedule period. Provide and maintain for foremen a complete schedule showing scheduled parts by types of machine tools and deliveries made against each part.
3. Release for delivery all material requirements in accordance with scheduled starting date requirements.
4. Contact production control clerks in other departments for delivery of originated parts to meet scheduled requirements.
5. Follow-up on movement of material between operations to assure completion date.

6. Keep in close contact with work of counters or checkers and record clerks in order to assure accuracy in records.
7. Confer with department's supervisor on all phases of production problems as they affect scheduled requirements.

Each production department has, in addition to the production control clerks, the services of production record clerks and production checkers or counters. Production record clerks prepare and maintain departmental production records and prepare such other reports as are necessary. Production checkers or counters properly identify, verify counts, and prepare delivery tickets and records on all parts after the last operation by a given department. This work is done either from a check-out station or from the point of last operation. Departmental production records consist of books which provide a complete record throughout a given season of all activity on all catalogue numbers scheduled. This record shows the following: catalogue number, name, quantity released, quantity of material or parts delivered in, and quantity delivered out. This record gives all information necessary for expediting purposes and also shows the condition of the schedule at all times. The number of copies of delivery tickets made for each delivery varies to meet the requirements of accurate records in all affected departments.

Our copy of the delivery or routing tag goes to the next department shown on the routing sheet and acts as a receipt or a quantity available. Releases are held in an active or inactive file. As soon as material leaves stores or the "feeder" department, the release for that part is transferred from the inactive to the active file. When final delivery is made from the department it is moved to the completed file.

***Controlling Production Flow***

The central office of production scheduling maintains a record on its production card of the quantity started or quantities completed on the first operation of every part. The responsibility of the central office of production scheduling lies in perfecting methods of scheduling of product to the production departments to the point of full and efficient use of machine capacities, equipment, and manpower. After they are assured that all scheduled items of production have been started, the responsibility of follow-up through processing, subassembly, and line assembly lies with the shop organization of the production scheduler.

By coordinating the output of each fabricating or subassembly department through the production control clerks who are schooled in the capacities and production flow of their respective departments, with the efforts of the production scheduler, production shortages are reduced to a minimum. True expediting is a matter of planning, of carefully weighing the in-process, storage, and transportation times, the necessary banks, and the dependability of vendors' shipping promises.

Once the assembly line has been set up to handle the desired rate of flow, the control of production to that line is chiefly a matter of feeding parts and subassemblies to the various work areas at the rate and time required. The guaranteeing of material at the line when needed is accomplished by the maintenance of stock banks along the line to be replenished on an economical basis. Large parts are serviced by the use of delivery conveyance or feeding lines.

The assembly line or any point of operations in which we are developing end product for storage or shipment will reflect in its efficiency of operations all the failures or mistakes that have been made in forecasting, material scheduling, procurement, storing, production scheduling, and operations. Continuous uninterrupted line assembly within scheduled periods is the reflection of well-planned production. The meeting of production schedules is our yardstick for measuring the efficiency of our production controls. We are now developing means of measuring our control on materials.

We have only recently developed a material budget for each one of our plant operations which is used as a yardstick in determining the efficiency of the works materials management. We are now working on a method of portraying the material status of each plant on a monthly basis. This analysis will show the value of materials in inventory and in process against the value of product manufactured. This statement will show materials on hand by commodity classification so that we will know where to direct our effort.

### *Summary*

This, then, is our conception of production and materials control for the plant and product I have discussed. As previously mentioned, production control or materials control, as we term it, is simply the application of common sense to the problem of planning,

executing, and accounting for a program of material conversion. I have seen many gadgets in use to relieve a particular production problem, when in reality an improved method of developing a source document would have eliminated the problem. Why cope with problems when they can be eliminated? We believe that in the manufacture of most products many of the production problems we are facing today would not exist, if the following conditions are met:

1. Manufacturing requirements are developed in accordance with shipping requirements by forecasting.
2. Materials are ordered and deliveries controlled to meet the requirements of fabrication or assembly.
3. Manufacturing requirements are within plant capacity to build.
4. Materials and parts are accurately received and inspected.
5. Materials and parts are released in kinds and quantities for fabrication or assembly in accordance with end product requirements, taking into account lead times.
6. The sequence of parts numbers run or assemblies made is controlled within each department.

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**Standard Costs in Small Business**

"In investigating the type of cost control to be installed, the cost accountant must not be misled by the popular belief that standard costing is applicable only to large manufacturing concerns. This method of cost control is obviously applicable to a business of any size carrying out repetition work, and I would suggest that as standard costing may be regarded primarily as a means of measuring the efficiency of a business operation, it is applicable in some form to any business".

*S. H. Richardson, "The Cost Accountants' Approach to the Small Manufacturing Industry," in* The Federal Accountant (Australia), *July 1946.*

# WHAT OPERATING MANAGEMENT NEEDS FROM ACCOUNTANTS

by THOMAS M. CHALMERS, Vice President,
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IN MY concept of what management requires, simplicity is the dominating factor. The bricklayer needs no mathematics for control of the quality of mortar required in meeting the specifications to which he is working. There you are dealing with a "one-two-three"—"sand-lime-cement" proposition. In the same way, the operating head requires that his information be furnished in just as simple language, or in such form that it is readily understood.

What management needs from the accountant can be a controversial subject, mainly because the accountant is required to go into the most minute detail in working up his figures so that his books balance and a true picture is on record of all the various transactions. For this reason, it is somewhat difficult for the operating head to secure only what he requires in order that he may have the control necessary for his responsibility in the over-all picture.

Before going into the need that management has of assistance from the accountants, it will be well first to discuss the responsibility of the operating department. This will furnish a better idea of why the operating department needs the accountant. The former is charged with the responsibility of manufacturing a quality product in the volume required and within the delivery time requested by our customers, at the lowest possible cost consistent with sound business principles. In performing this function, the operating department has the responsibility of not only producing a sufficient volume of products in the time desired by the sales department, but in addition this material must be produced, if possible, at such a cost as will result in a profit to the company. The end point, therefore, of the operating management's job is production at a profit. Hence operating management is concerned that control over operating costs exists at all times.

### *Costs and Profit Margins*

At the present time there are several major factors which tend to narrow the margin of profit which, in turn, demands that operating management pay special attention to the problem of controlling operating costs:

1. The income from our products has not kept pace with rising costs of material and labor.
2. More complex processing is necessary to satisfy customer demands for a greater variety of finished products.
3. Prices for new products must be based on careful estimates. Small errors in the estimated cost could easily result in quoting a price which would result in a loss rather than a profit.

To maintain a profit margin we must constantly develop new products, change and improve existing product lines, and review and improve manufacturing methods in order to maintain the participation and obtain a reasonable return on the investment.

In handling all of these problems it is necessary that operating management be furnished cost data by the accountant which are based on sound accounting principles, and contain only that which is necessary to furnish the control data required.

***Needs of Departmental Management***

Departmental management also has need for the accountant. The place to control current operating costs is at the point where they are incurred, namely, at the blast furnace, open hearth, or at the various mills which are being operated. To control current costs properly certain conditions are necessary. First, each foreman or departmental superintendent who incurs any expense should be furnished a statement of the cost he incurs and a comparison of this cost with that of which he should have incurred, based on predetermined standards, together with an explanation of the causes of any significant variations which exist between his actual and standard or budgeted costs. Again, each foreman or departmental superintendent must realize that his costs are dependent largely upon the trend of certain key items, such as production rate and yield (which is the ratio of finished product to the amount of raw material required to produce it). Hence, for the foreman or departmental superintendent to control his cost it is absolutely essential that his performances on these key items should be furnished him daily, analyzed by turns, and also on cumulative basis, month to date. Thus the foreman and the departmental superintendent will be in a position to take whatever corrective actions are necessary immediately. If the accountant delays until the end of the month to furnish these data, the chances are

that an unfavorable variance will continue uncorrected for a good deal longer period of time, and thus incur a greater loss than if this condition had been reported on the day following its initial occurrence. On the other hand, if this condition were temporary, the chances are that the foreman, by the end of the month, will have forgotten just what the conditions were that brought about the abnormal cost.

### *Additional Data*

To enable the foreman or departmental superintendent to exercise proper cost control it is necessary for the accountants to furnish him periodically with additional data. The one with which we are most familiar is the monthly operating statement, which is an accumulation of the turn and daily reports, supplemented by those items of cost not reported on the turn and daily reports. The operator also should be furnished with an analysis of delays by causes, such as failure of various parts of mill equipment and failure arising from substandard quality of the material processed. In addition, the operator should be furnished with an analysis of his maintenance expense, broken down by each item of equipment. In the steel industry maintenance expense makes up a very large part of the total operating cost. This analysis will provide the operator with a check on the effectiveness of his program of preventive maintenance; it will provide a check on the performance of the shops in making repairs; it will provide the operator with data on which to base requests for the purchase of new equipment to replace worn-out units; and it will provide management with a check to determine whether or not the equipment is being abused or properly maintained by the operators.

Finally, the accountant should furnish the departmental management periodically with an operating analysis of variations in rolling or operating performance. This will provide the operator with a check as to the quality of material being processed. It will enable him to determine any lack of uniformity in the method of processing followed by the various crews; and it will enable him to spot excessive delays due to equipment failure, which may reflect on the adequacy of his preventive maintenance program.

### *Departmental Accounting*

The accountant can best assist the departmental management by establishing local accounting offices in connection with each pro-

ducing unit. This will enable the departmental superintendent to establish adequate local accounting and to have easy and quick access to all his cost data. This arrangement will also benefit the accounting department by placing it in the best position to keep up with the activities of the department for which they are furnished cost control data. Then, too, the accountant can also assist the operator by establishing a system of accounting based on responsibility centers and including standards for measuring the performances of the operators for various operating conditions.

The accountant can further assist the departmental superintendent by preparing the turn and daily reports, as well as the periodic reports listed earlier in the simplest form so that the operator can, at a glance, determine the result of his activities in dollars and cents.

This will indirectly affect costs by giving the departmental operator the feeling that he is in business for himself, as he knows that his superiors will see the results of his efforts in a statement which sets out his performance on those factors over which only he has control.

### *Needs of Works Management*

Turning our attention to the needs of works management for the accountants, several points may be raised in this connection. Works management is responsible for carrying out the policies and plans of top management. The manager is, therefore, primarily concerned with the production of the desired amount of finished product to meet the delivery date promised to our customers. This must be produced at a cost consistent with that set out in predetermined standards established for current operating conditions.

To perform this function, works management must rely upon the accountant for a daily check on the over-all factors affecting the performance of each producing unit, such as volume of production, delays, yield, operating performance, and inventory. This information must be furnished as quickly as possible and must be subject to as few end-of-month adjustments as possible. This will enable works management to take whatever steps are required to insure that no "fall-downs" occur in meeting the delivery dates and at the same time that costs are held in line. In order for works management to control its costs, it is necessary that the departmental managements keep their costs under control by meeting their expected performance. In addition to this, the works man-

agement should be informed periodically of the performance of all nonproducing units within its jurisdiction. By so doing, the works manager will be enabled to maintain control over many important items of cost, including his shops division.

### *Monthly Summary*

Works management also needs from the accountant a monthly summary of costs as compared to standards and an analysis of the significant variances. It is rather difficult for the works manager to keep at his finger tips at all times all items pertaining to cost during the entire month. Then, too, he does not have the time to analyze at the end of the month a thick volume of operating statements covering each of the units for which he is responsible. Therefore, the accountant can be of great assistance by preparing a monthly report to works management pointing out the significant features contained in his operating statements. Each works manager has his own idea as to the features of costs he is most interested in following. Therefore, the accountant should work closely with him in determining the information to include in this report. In this way, he makes certain that only those items are discussed in which the works management is interested, and that other material which might be interesting, but not pertinent to the operating problems, is excluded. Most of us have some problem of satisfying operating management. There are many instances of operating supervisors performing the same functions who will ask for different data. This is quite understandable as no two men function alike and very few men think alike. Therefore, the accountant must be versatile in his thinking and sufficiently broad-minded to take into account these factors and endeavor to furnish that which is necessary to satisfy the needs of the individual.

### *Cost Reduction*

The works manager can improve his costs by instituting changes in equipment on the advice of the engineering department. Costs also may be improved by instituting process changes based on the advice of the metallurgical department, or by introducing method changes or wage incentive plans on the advice of the industrial engineering department. In each case, of course, the technical department in question works with the operating department. The effect upon costs of these changes and many other cost reduction plans

must be evaluated by the accountant periodically and reported to all interested parties.

***Manufacturing Specifications***

Top management can provide certain tools to assist department and works managers in controlling their costs. These tools are also available to the accounting organization and should be used by them in developing their costs. Thus the industrial engineering department can provide invaluable assistance in this connection through the establishment of manufacturing specifications and basic standards. Manufacturing specifications, as we know the term in the Tennessee Company, establish a basis for essential standardization of methods and production for each operation by providing a complete, written record of proved operation factors in the simplest and most usable form.

Manufacturing specifications for each operating department are broken down into seven classes:

1. Material specifications cover the type of products made by each department and material used.
2. Process specifications show the various metallurgical process details that are necessary for the manufacture of quality products.
3. Inspection specifications establish approved mill and final inspection requirements.
4. Equipment specifications provide a description and essential data for each piece of equipment.
5. Crew specifications specify the approved number of men, by products, and for various levels of operations.
6. Method specifications establish the approved method for operating various units of equipment.
7. Drafting specifications establish standard drafting practice for all products produced on rolling mills. Drafting refers to the amount of reduction taken each time the heated metal is passed or repassed between the rollers, either in a blooming mill or a finishing mill.

It is thus apparent that manufacturing specifications provide information which will enable management to maintain an effective control over the operations of a department and, if properly used, become a basic item of both cost control and quality control of product.

### *Basic Standards*

Basic standards are authorized measures of operations that show, in practicable terms, the standard amount of time or the quantities of materials that are necessary to manufacture given quantities of individual products. Thus, basic standards for each product are developed by combining method and time study data with the information contained in the manufacturing specifications.

The following are the major elements included in basic standards prepared for each product:

1. Crew requirements, by occupations.
2. Production per hour.
3. Material usage.
4. Supplies usage.
5. Utilities usage.
6. Time allowances (for delays, for changing rolls, etc.).
7. Any other factors affecting manufacture.

Basic standards, therefore, provide the accountant with the basis for establishing a cost system which will determine normal costs, profitable production, correct distribution of overhead, and the effect of all variances, including sales volume. It will provide the accountant with the basis for a cost control report which will reflect departmental operating performance, equipment expense, and all other material losses.

### *Quality Control*

Top management can provide department and works management with the assistance of plant metallurgists and inspectors who, by maintaining a day-to-day check on all producing departments, check off-standard methods of operation which result in poor quality product and high finishing costs. Metallurgists and inspectors provide management with that invaluable tool for keeping costs as low as possible.

We have stressed the need of industrial engineering in cost control. The metallurgical engineer can be of equal service, both to management and to the accountant, in that he is charged with the responsibility for maintaining the standards which reflect the quality of the product being produced. Hence, in order for the accountant to function properly in cost control and give management what is required, he very definitely must have the assistance of intelligent metallurgical engineers.

### *Equipment Design*

Top management can also provide department and works management with engineering assistance. An engineering department can be of great value in designing equipment to reduce maintenance costs and to develop new equipment to reduce operating costs by changing existing methods. The engineering department is also invaluable in designing equipment to produce new products. Although the engineering department's work is not so closely connected with the accountants as are the industrial engineers' activities, it is very definitely tied in with cost control. They are not only the designers of our equipment, but in designing this equipment they, through necessity, write into our standard specifications the necessary standards of operation.

### *Maintaining Expected Production*

Top operating management, as indicated previously, has the responsibility of insuring the production of the volume of quality steel which the sales department will require to furnish the trade at the lowest possible cost consistent with sound business management. This involves two separate functions. The first of these is to see to it that works management maintains the expected level of performance in the production of steel with the existing equipment. The accountant can assist top management in this task by furnishing daily reports on production, inventory, shipments, etc., by departments, and by furnishing periodically during a month summaries of performances by works. These periodic summaries should not include a complete operating statement, but only a statement reflecting the performance of the key items of cost over which the departmental superintendents and works management have control. It is sufficient for top management to be provided with such a check at intervals during the month, as the performances reflected in these reports will indicate whether or not operating costs are under control, and consequently, whether or not the final monthly operating statement will indicate a profit or loss.

The accountant can further assist top management in the task of reflecting the current performances of works management by preparing each month a report explaining the significant points in the monthly operating statements. As in the case of works management, top management does not have the time to study and analyze each monthly operating statement for each works and department. It is, therefore, necessary for the accountant to prepare a

brief report indicating the accomplishments of each works during the month and pointing out any significant variances that occurred which might indicate that operating conditions are getting out of control. Copies of this report should also be furnished the works managers in order that they may be in position intelligently to discuss their problems with top management and recommend methods whereby the occurrence of any unhealthy condition may be brought under control.

***Long Range Plans***

The second major function of top management is to develop long range plans for the future. The top executives must focus their attention on the task of effecting readjustments of changing conditions. Change is the one thing of which we can be most certain in business administration. Conditions change in every industry and in every enterprise sooner or later because of the discovery of new material, the introduction of new technical processes and other technological innovations, the adoption of new methods of transportation and communication, the modification of demand resulting from changes in living habits, the growth or decline of population, or alterations in tastes and style. Wars, governmental policies, community sentiments and attitudes, and social customs also cause business situations to change. Such are some of the major external factors which necessitate readjustment of business plans and organization. Internal changes also occur because decisions are made which set in motion new combinations of forces, or because new managerial techniques are introduced, or men grow old and die. If an enterprise is to survive it must constantly adjust itself to meet these changing conditions. It is on the chief executives of an enterprise that the burden of planning readjustments to changing conditions falls. They must make decisions projecting into the future. The subordinate executives aid in making these decisions and carrying out the plans decided upon, but the final responsibilities rest with the chief executives. In fact, the leadership of executives is needed primarily for meeting changing conditions, for laying plans, and for making the decisions required by new developments.

Thus, the operating management must secure from the sales executives forecasts of the estimates of future sales. These forecasts will indicate the need for expansion for new products and new processes and for altering or discontinuing old products.

***Assistance by Accountant***

The accountant can assist top management in this task by the preparation of a monthly profit and loss statement. The trend in the profit and loss is indicative of a company's well-being. The periodic preparation of profit and loss statements by products should be presented by the accountant so as to compare actual versus standard costs for each item sold. This will enable top management to determine whether a product is losing money due to poor mill performance or to decline in price. The first indicates that action is required at the works. The second condition indicates a need for a conference with the sales department to determine whether the product should be discontinued or purchased from another company, or whether the decline in price is due to competitive conditions. The last condition indicates that action must be taken with the engineering and metallurgical departments to take whatever steps are necessary to rectify the situation.

The accountant can further assist top management by developing estimates of savings that would result by expanding or altering mills or equipment. These data will make it possible to determine whether or not sufficient saving could be expected to justify the investment required. The accountant can assist top management by providing data relative to the cost of new products or modification of existing products. This will enable top management to determine whether sufficient profits are in sight to make it worth their while to incur whatever necessary expenses will be involved in the production of these products.

***Assistance to Accountant***

This discussion would not be complete without mentioning briefly some of the ways in which management can provide assistance to the accountants. First, top management should provide a competent accounting organization. Probably too many companies feel that accountants are bookkeepers and therefore the cost of the department should be kept at a minimum. If management expects to receive first-rate accounting assistance (and without this it cannot operate successfully for any length of time in the highly competitive world of today), it is essential that sufficient support be given to the accounting department to enable it to build a first-class organization.

Second, management can be of benefit to the accounting department by furnishing fairly explicit directions as to the needs, and

then holding it to a high standard of performance. In preparing such a report the accountant must include the data which the operator needs to control his operation. These reports should be prepared in the simplest and most concise form for the operator to realize the greatest benefit from them. I feel that it will be of great assistance to the accountant if the operating management insists that these reports be provided and that any additional data should be prepared which the operator feels is required for the proper performance of his responsibility. Until the accountant meets these needs he is not performing his job in the organization.

Third, the operating management can be of assistance to the accountants by bringing them into the discussion of any problem in which they are involved at the earliest possible moment. This will minimize work by the accountants in preparing reports for the operators which would not have been necessary had the operating departments advised them of their needs earlier. Such a policy benefits the operators as well as the accountants, since the early development of pertinent data saves them considerable time which otherwise would be spent in discussing solutions to problems which accounting data would indicate as being excessively costly.

***Conclusion***

I have tried briefly to outline some of the many needs which various levels of operating management have for assistance from the accountants. Although concerned mainly with the iron and steel industry, the statements can be applied generally, as, after all, the problems of operating management are pretty much the same throughout the world of business.

In concluding, it should be emphasized that, to be of greatest value, the data in the reports which accountants furnish operating management should be prepared promptly in the briefest and most concise form. Finally, since any business is made up of various groups of men, each performing those functions for which they are best qualified, it is essential that organization lines be followed. The accountant, like the engineer, metallurgist, and industrial engineer, performs a valuable staff job in providing operating management with data on which to make sound decisions. It is operating management's responsibility to evaluate the facts disclosed by data submitted by the staff departments and then make the necessary decisions for operating the business.

# LOADING